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New western species of Gymnosporangium and Roestelia

FRANK DUNN KERN

Examination of a large number of specimens of *Gymnosporangium* and *Roestelia* from the Rocky Mountains has clearly shown that there exist in that region several species very unlike any now known in the eastern states or in foreign countries. Some of these western species are represented in the larger cryptogamic herbaria and are labeled with the names of other species, to which they have some slight resemblance, or are undetermined. For the most part they possess strong diagnostic characters and are easily distinguishable from the eastern species, but cultures, to supplement field observations, are necessary before the telial and aecial forms can be definitely connected. In order that the western species may be properly recognized, and for the sake of convenience in referring to the two stages independently before they are connected, the present paper characterizes six new species, three of *Gymnosporangium* and three of *Roestelia*. Studies of the western species in this group have been very materially advanced by the co-operation of Professor E. Bethel, of the East Denver High School, both through his many contributions of unusually fine specimens and through advice and assistance rendered to Professor J. C. Arthur and the writer, while on a collecting and observation trip in Colorado during the latter part of April and first part of May, this year.

Gymnosporangium Betheli sp. nov.

Telia appearing on irregular, elongated, gall-like knots varying from a few millimeters to several centimeters across, unevenly disposed, wedge-shaped, 1–1.5 mm. broad by 1–3 mm. long at the base by 3–4 mm. high, chestnut-brown, epidermal tissues raised and torn about the base; teliospores ellipsoid, 17–25 by 40–55 μ, rounded or somewhat narrowed above and below, slightly or not constricted at the septum, wall dark cinnamon-brown, varying in thickness on different spores, 1–2 μ, smooth, pedicel hyaline, cylindrical, uniform, 6–7 μ in diameter, very long, pores 2 in each cell, near the septum.

On branches of *Sabina scopulorum* (Sarg.) Rydb. (*Juniperus scopulorum* Sarg.), Boulder, Colorado, April 27, 1907, *Bethel & Kern* (type); Horsetooth Gulch, Fort Collins, Colorado, June 30, 1893, *C. F. Baker 124;* Walcott, Colorado, July, 1905, *E. Bethel,* May 2, 1907, *F. D. Kern;* Laramie Hills, Wyoming, September 13, 1899, *A. & E. Nelson 6907.* Type in the herbarium of J. C. Arthur.

This is without doubt the most injurious to the cedars of all the species. It produces gall-like knots on both small and large branches. The mycelium is perennial, but does not produce new hypertrophy within the scars of the old, but always extends to the unaffected tissues beyond or at the side. This gives the characteristic appearance of new galls beside the old galls. The tendency is for the succession of galls to break forth along the grain of the wood, thus forming an elongated area of hypertrophy. In the selection of a name the author takes the opportunity to show his appreciation of the courtesies shown by Professor Bethel in sending specimens and otherwise assisting in the study of this group, and especially of this species. Professor Bethel has made numerous collections of this species and has suggested a probable roestelia connection as a result of his excellent field observations.

Gymnosporangium durum sp. nov.

Telia appearing on firm, regular, globoid galls 0.5–5 cm. in diameter, unevenly disposed, sometimes aggregated, often separated by the scars of the sori of previous seasons, irregularly flattened, about 1–1.5 mm. broad by 1–5 mm. long at base by 3.5 mm. high, often confluent, light chestnut-brown, torn epidermal tissues not conspicuous; teliospores narrowly ellipsoid, 18–22 by 50–65 μ, narrowed at both ends, slightly constricted at the septum, wall pale cinnamon-brown, 1–1.5 μ thick, smooth, pedicel hyaline, cylindrical, uniform, 4–6 μ in diameter, very long, pores 2 in each cell, near the septum.

On branches of *Sabina utahensis* (Engelm.) Rydb. (*Juniperus californica utahensis* Engelm.), Glenwood Springs, Colorado, May 1, 1907, *F. D. Kern* (type), July, 1905, *E. Bethel;* Durango, Colorado, July 20, 1898 or '99, *Baker, Earle & Tracy,* May 24, 1907, *H. N. Wheeler,* communicated by E. Bethel; Mancos, Colorado, July 18, 1898, *Baker, Earle & Tracy.* Type in the herbarium of J. C. Arthur.

This species is characterized by the very regular, nearly globose, hard, woody gall which it produces. The mycelium is perennial for a few years or until the gall is usually several centimeters in diameter. The galls remain hanging on the trees for years. They are harder and more nearly globose than the galls produced by the eastern *G. globosum.*

Gymnosporangium inconspicuum sp. nov.

Telia usually arising between the scale-like leaves on the green branches, or rarely on the woody branches, scattered or usually aggregated and confluent, oblong, pulvinate, about 0.4–1 mm. wide by 0.5–1.5 mm. long by 0.5–1 mm. high, reddish-brown; teliospores oblong-ellipsoid, 25–29 by 55–80 μ, roundish or often acutish at apex, obtuse below, wall thin, about 1 μ, golden-yellow, smooth, pedicel hyaline, carotiform, swelling greatly next to the spore, 25–65 μ, very long, pores one in each cell, apical in the upper, near the pedicel in the lower cell.

On small branches of *Sabina utahensis* (Engelm.) Rydb. (*Juniperus californica utahensis* Engelm.), Glenwood Springs, Colorado, May 1, 1907, *Arthur & Kern.* Type in herbarium of J. C. Arthur; known only from the type locality.

As the name implies, this is a very inconspicuous species, and this fact undoubtedly accounts for its being overlooked up to the present time. The small, pulvinate sori breaking forth between the leaves soon become gelatinized and form a film over the surface of the leaves. In this condition it appears as if the spore-masses of some larger gall-form had dropped upon the leaves and clung there. In fact it was only after a great abundance had been seen that it was examined closely enough to be recognized as a genuine species. The teliospores are the largest of any of our known species. In general form they resemble *G. clavipes*, but are larger and the pedicel is swollen much more. Fruits of *Amelanchier* of the previous season, badly infested with a roestelia, were found still hanging to the trees in close proximity to the cedars abundantly bearing *G. inconspicuum* and it is strongly suspected that these forms may be different stages of the same species.

Roestelia Betheli sp. nov.

Pycnia fruiticolous and epiphyllous, numerous, gregarious, more or less crowded in irregular groups on discolored spots, punctiform, subepidermal, honey-yellow becoming blackish, flask-shaped, 130–160 μ in diameter by 100–112 μ high; ostiolar filaments 45–65 μ long.

Aecia fruticolous and hypophyllous, densely aggregated or in small groups on discolored spots, cylindrical, 0.2–0.3 mm. in diameter, 3–8 mm. high; peridium dingy-white, becoming finely lacerate above, often nearly to base, spreading, cells linear-rhomboidal in longitudinal section, 16–20 by 60–90 μ, overlapping and imbricated, outer wall thin, 1–1.5 μ, inner wall moderately thick, 4–6 μ, coarsely rugose with closely set linear ridges directed outward and downward, hygroscopic; aeciospores globoid, 18–24 by 23–30 μ, wall chestnut-brown, 2.5–3 μ thick, finely verrucose, pores several, scattered.

On fruit and leaves of *Crataegus Cerronis* A. Nels., Boulder, Colorado, September 1905, *E. Bethel* (type), August 17, 1906, *E. Bartholomew.*

On leaves of *Crataegus saligna* Greene, Wolcott, Colorado, September, 1898, *C. L. Shear 947* (in Griffiths' West Am. Fungi, *no. 333*).

This is a very vigorous species developing an unusually long peridium. It is interesting on account of its supposed relation to *Gymnosporangium Betheli*, described above. The same specific name is applied to both forms with the hope that cultures will soon establish their identity.

Roestelia Harknessiana Ellis & Ev. sp. nov.

Pycnia unknown. Aecia fruiticolous, evenly disposed, cylindrical, 0.5–0.8 mm. in diameter, 4–7 mm. long; peridium golden-brown, tough, not becoming lacerate, cells rhomboidal in longitudinal section, 58–74 by 90–112 μ, somewhat overlapping, outer wall moderately thick, 4–6 μ, smooth, inner wall thick, 15–20 μ, rather coarsely and evenly verrucose with roundish or slightly irregular papillae; aeciospores globoid, 22–26 by 26–30 μ, wall light cinnamon-brown, 2–2.5 μ thick, finely verrucose, pores several, scattered.

On *Amelanchier alnifolia* Nutt., Klamath River, California, July, 1887, collector unknown, communicated by H. W. Harkness (in Ellis & Ev. N. Am. Fungi, *no. 2714*). Type in the Ellis collection at the New York Botanical Garden.

The collection here listed was issued by Ellis & Everhart in their North American Fungi (*no. 2714*), in May, 1892, without any accompanying description. The name has since been used, but in an examination of the literature no publication with a description has been found. A Colorado collection was later issued under the same name (Ellis & Ev. Fungi Columb. *1293*, May, 1898), but it is very different both in gross and microscopical appearance and belongs with the new species proposed below. The geographical range of *R. Harknessiana* suggests a possibility of a connection with *G. Libocedri* (P. Henn.), which has the same limited distribution, but there is at present no other clue to introduce as evidence of their relationship.

Roestelia Harknessianoides sp. nov.

Pycnia fruiticolous, numerous, scattered or often more or less crowded over considerable areas, punctiform, subepidermal, honey-yellow becoming blackish, globoid, large, 160–220 μ in diameter by 150–210 μ high, ostiolar filaments 65–80 μ long.

Aecia fruticolous, scattered irregularly or crowded over the entire surface, cylindrical, 0.5–0.8 mm. in diameter, 2–4 mm. high; peridium yellowish-white, rather tough, not becoming lacerate, cells rhomboidal in longitudinal section, 45–55 by 65–100 μ, overlapping, outer wall moderately thick, 5–8 μ, smooth, inner wall very thick, 27–35 μ, moderately and closely verrucose with slightly irregular papillae; aeciospores globoid, 23–27 by 25–31 μ, wall pale-yellow, 2–2.5 μ, finely verrucose, pores obscure, scattered.

On fruit of *Amelanchier oreophila* A. Nels., Glenwood Springs, Colorado, July, 1905, *E. Bethel* (type in herbarium of J. C. Arthur).

On fruit of *Amelanchier alnifolia* Nutt. (?), Colorado, *E. Bethel* (in Ellis & Ev. Fungi 1293).

A very interesting species occurring only on the fruit. It has been confused with *R. Harknessiana* from which it differs in having shorter, lightly-colored peridia, peridial cells with a much thicker inner wall, and finer, closer markings, and spores with a lighter wall. It has a superficial resemblance and a similar habit of growth to the genuine *R. Harknessiana* and in separating it the name *Harknessianoides* has been chosen in order that it may carry with it this suggestion. This is the species mentioned above as having a possible connection with *Gymnosporangium inconspicuum.*

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